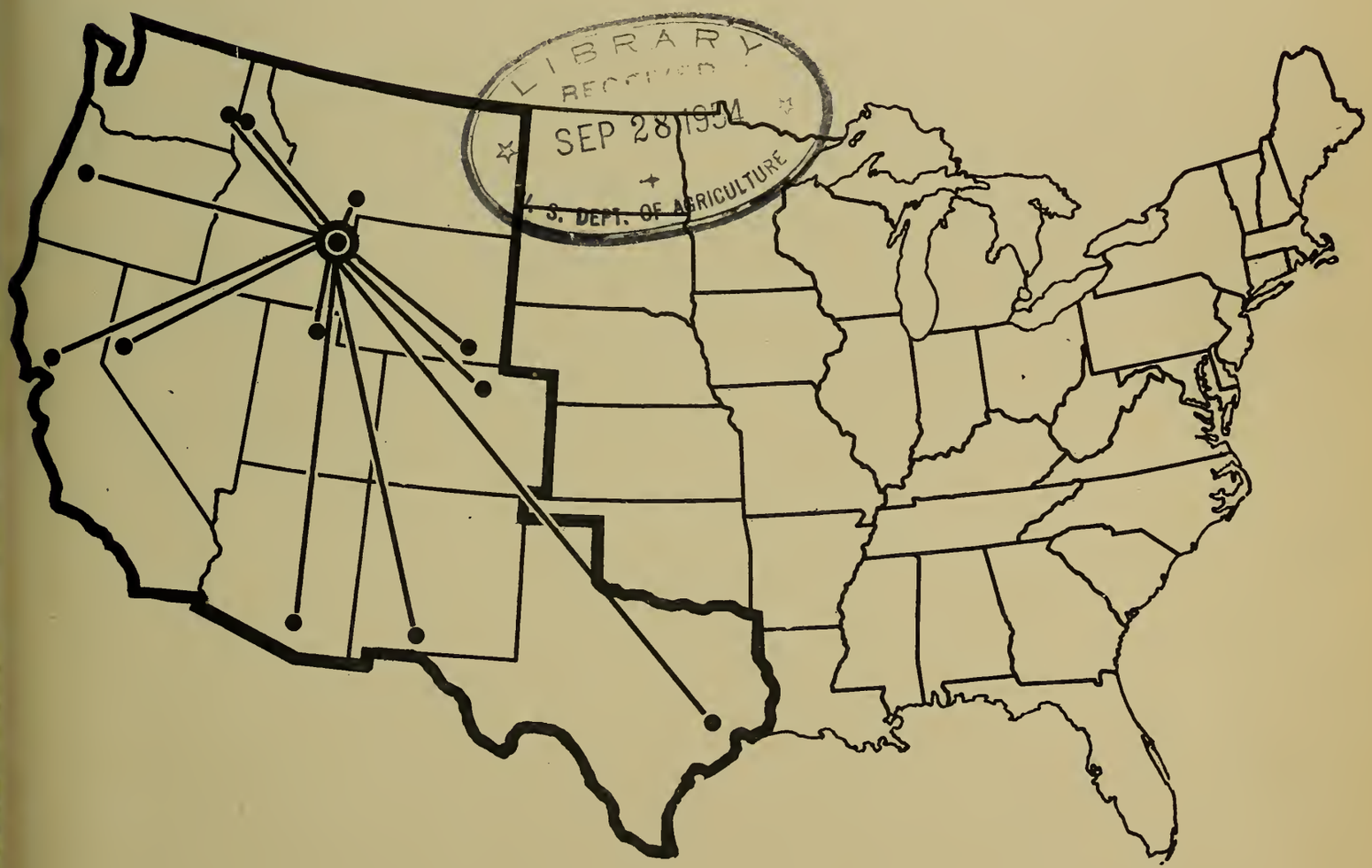
UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF ANIMAL INDUSTRY
AND COOPERATING STATES

TENTH ANNUAL REPORT OF THE

WESTERN SHEEP BREEDING LABORATORY

DUBOIS, IDAHO

JUNE 30, 1947



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ANNUAL REPORT
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June 30, 1947

TABLE OF CONTENTS

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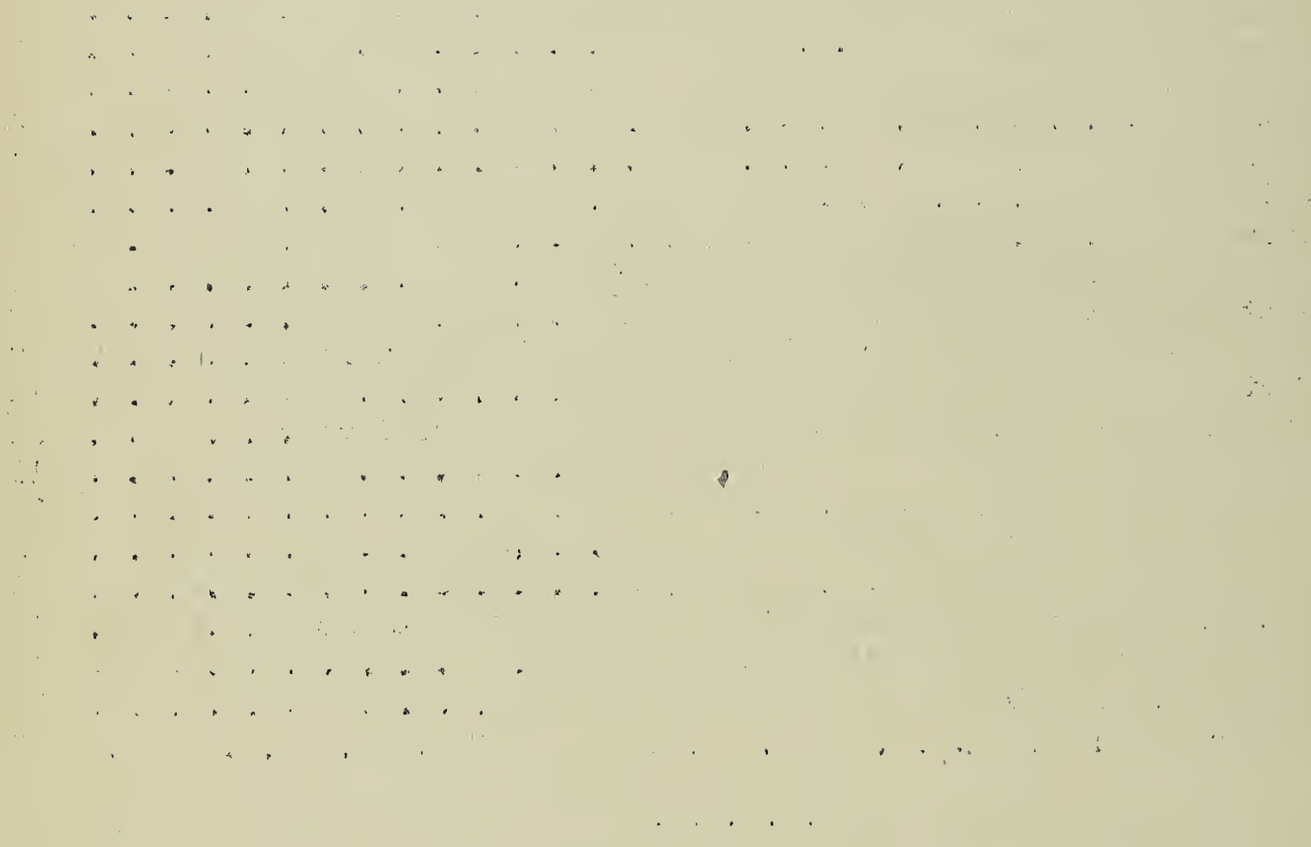

DIRECTORS OF STATE AGRICULTURAL EXPERIMENT STATIONS OF THE TWELVE WESTERN STATES THAT ARE COLLABORATING WITH THE WESTERN SHEEP BREEDING LABORATORY

ARIZONA:	P. S. Burgess, University of Arizona, Tucson.
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MONTANA:	Clyde McKee, Montana State College, Bozeman.
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COLLABORATORS OF THE WESTERN SHEEP BREEDING LABORATORY

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TEXAS	Bruce L. Warwick, Department of Animal Industry, Texas Agricultural Experiment Station, College Station.
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WYOMING:	Fred S. Hultz, Head, Department of Animal Production, College of Agriculture, University of Wyoming, Laramie.

ROSTER OF PERSONNEL

WESTERN SHEEP BREEDING LABORATORY AND U.S. SHEEP EXPERIMENT STATION
Dubois, Idaho, as of June 30, 1947

Name	Rating	Date entered on duty	General Duties
Nordby, Julius E.,	Animal Husbandman P-6	March 1, 1938	Director
Terrill, Dr. Clair E.,	Animal Husbandman P-5	July 3, 1936	Geneticist, Physiologist
Stoehr, John A.	Animal Husbandman P-4	Aug. 28, 1928	Operations
Emik, Dr. L. Otis,	Animal Husbandman P-4	July 7, 1941	Physiology and Genetics
Wilson, Lowell O.,	Scientific Aid SP-4	July 1, 1943	Assistant, Wool laboratory
Schaefer, Chester F.,	Clerk, CAF-5	June 22, 1936	Chief Clerk
Jeffery, Lee C.,	Foreman of Farm Laborers, CPC-6	June 7, 1924	General maintenance pumps, equipment
Rasmussen, Henry, Jr.,	Farm Laborer CPC-5	July 1, 1926	Farm Laborer
Hohman, Max E.,	Farm Laborer CPC-4	April 1, 1935	Shepherd
Landacre, Harold E.,	Farm Laborer CPC-4	April 6, 1939	Truck driver, general maintenance
Goldman, James R.,	Farm Laborer CPC-4	May 1, 1939	Shepherd
Howard, John H.,	Farm Laborer CPC-4	Oct. 2, 1944	Shepherd and Camp Tender
Ingram, Pete F.,	Farm Laborer CPC-4	April 20, 1947	Shepherd
Phillips, Walter H.,	Farm Laborer CPC-4	March 16, 1935	Truck Driver
Powell, Fred A.,	Farm Laborer CPC-4	May 11, 1935	Teamster
Swink, Albert B.,	Farm Laborer CPC-4	May 31, 1946	Farm Laborer
Zufelt, Glenn	Skilled Laborer Unall.	May 20, 1947	Farm Laborer
Nantz, Dorinda R.,	Laborer CPC-2	June 16, 1941	Janitress and Cook

OBJECTIVE

The main objective of this Laboratory is to improve sheep for lamb and wool production under range conditions. In the pursuit of this objective basic breeding methods are employed; heritability analyses are made of the various utility factors, and the selection of breeding animals is based upon production as that is measured under range environment. Emphasis is placed primarily on the quantity and quality of lambs produced; the length, quality and quantity of clean scoured wool, and upon the adaptability and longevity of the sheep.

RESEARCH LINE PROJECTS

1. Development of systems of breeding for locating strains of Rambouillet sheep which may possess combinations of genes that will improve strains with which they may be crossed. This research line project includes:

    (a) The development of inbred strains or lines by the mating of animals as closely related as possible or desirable, and with emphasis on selection for all characters of economic importance.

    (b) The development of inbred lines with special reference to very important characters that are of economic importance to range sheep, such as mutton form, length of staple and faces that are free from excess wool covering causing wool blindness.

2. Determination of the inheritance of various undesirable characteristics of Rambouillet sheep, such as abnormalities in the growth of wool, hairiness in fleeces of wool and excessive skin folds or wrinkles, for the purpose of developing methods of breeding by which these undesirable characteristics may be eliminated from the stock.

3. Studies in the physiology of reproduction of Rambouillet sheep as they may contribute to the program of the Western Sheep Breeding Laboratory, including

    (a) Sexual maturity of Rambouillet ram lambs.
    (b) Quality of semen in relation to fertility, and
    (c) Factors affecting fertility of ewes.

4. Studies in the physiology of wool production of Rambouillet sheep including reference to fiber uniformity within and between various regions of the fleece in relation to the total uniformity of the fleece.

5. Analysis of records of the characteristics of sheep and wool to determine the usefulness of such records in the program of the Western Sheep Breeding Laboratory.

PUBLICATIONS
Fiscal year 1947

Titles of papers from 5 to 55 appear in 1946 Annual Report. See also Annual Report U. S. Sheep Experiment Station 1947 for additional publications in 1947 by personnel of staff.

Papers identified by an asterisk (*) have been contributed to by the U. S. Sheep Experiment Station.

30. Sampling and Measuring Methods for Determining Fineness and Uniformity in Wool. Elroy H. Pohle, L. N. Hazel and H. R. Keller, U.S.D.A. Circular 704, August 1944. Revised March 1947.

53. Effects of Some Environmental Factors on Fleece and Body Characteristics of Range Rambouillet Yearling Ewes. L. N. Hazel and Clair E. Terrill. Jour. An. Sci. 5(4):382-388, Nov. 1946.

*54 Length of Gestation in Range Sheep. Clair E. Terrill and L. N. Hazel. Amer. Jour. Vet. Res. 8(26): 66-72, January, 1947.

55. Refining Methods of Using Opal Blue Stain in Evaluating Ram Semen. L. O. Emik and G. M. Sidwell. Jour. An. Sci. 6(1): 67-71, February, 1947.

*57. Range Sheep Improvement Through Selection. Clair E. Terrill, Nat'l Wool Grower 36(12): 17-19, December, 1946.

*60. Its the Clean Wool in the Fleece That Pays Off. Elroy H. Pohle, Nat'l Wool Grower 37(5): 19-20, May, 1947.

*61. Statistical Treatment of Counts of Trichostrongylid Eggs. L. Otis Emik. To appear in Biometrics.

*62. Factors Affecting the Estimation of Concentration of Sperm in Ram's Semen by the Photoelectrometric method. L. Otis Emik and George M. Sidwell. To appear in Journal of Animal Science.

64. Differentiation Between Artificial and Defective Tailless Sperm From Rams. L. Otis Emik and George M. Sidwell. For Journal of Animal Science.

*65. Gestation Period in Sheep. Clair E. Terrill and John A. Stoehr. To appear in Woolgrower's magazines.

67. Effects of Some Environmental Factors on Traits of Yearling and Mature Rambouillet Rams. Clair E. Terrill, G. M. Sidwell and L. N. Hazel. For Journal of Animal Science.

68. Improvement of Sheep for Western Ranges. Julius E. Nordby. To appear as a U.S.D.A. Misc. Circular.

*69. Effect of Feed and Sickness on Wool Growth. Elroy H. Pohle. National Wool Grower. Vol. 37, No. 6, June 1947. Page 9.

ABSTRACTS

15. The Construction and Use of a Selection Index for Range Rambouillet Lambs. L. N. Hazel and Clair E. Terrill. Jour. of An. Sci. 5(4): 412, Nov., 1946.

*16. Factors Affecting the Estimation of Concentration of Sperm in Ram's Semen by the Photoelectrometric Method. L. Otis Emik George M. Sidwell. Anat. Rec. 97(3): 69-70, March, 1947.

PROGRESS IN INBRED LINES OF RAMBOUILLETS

Matings were continued in 30 inbred lines during the year 1946-47. No lines were added or dropped during the year. The number of ewes bred remained about the same as in the preceding year.

Changes in inbreeding since the project was initiated are shown in the following table:

		Inbreeding coefficients in percent based on ewes bred					
Year lambed	Potential inbred lines	Sires	Dams	Progeny	Increase of progeny over dams	Highest for progeny of any pen	Highest for any individual offspring
1938	20	4.0	1.1	3.9	2.8	13.3	37.9
1939	22	7.5	3.2	7.2	4.0	30.3	58.3
1940	34	6.0	3.6	8.2	4.6	32.6	58.3
1941	36	3.3	2.7	8.6	5.9	31.2	47.3
1942	37	4.1	4.0	8.6	4.6	28.7	39.9
1943	30	4.4	4.2	8.9	4.7	23.0	36.9
1944	30	5.0	5.0	10.3	5.3	22.8	48.0
1945	30	6.0	5.8	14.2	8.4	26.8	42.5
1946	30	5.9	7.1	14.1	7.0	25.7	39.4

There was a slight decrease in inbreeding in 1946. This may have been due to changing rams in many lines as 25 of the 30 rams used had not been used previously. About one third of the rams used were not inbred themselves. About 95 percent of the ewes were mated to related rams. Some lines still contain foundation ewes which are not related to the current sire.

The first 6 lines for each of the more important traits are listed in the following table for comparison with similar tables presented in previous years. These lines were ranked on adjusted averages from weanling offspring in 1946.

Trait	1st	2nd	3rd	4th	5th	6th
Body weight	34	40	22	45	24	32
Body type	45	34	47	22	39	24
Condition	34	40	42	45	29	21
Staple length	29	47	39	20	53	45
Open face	40	51	44	22	27	45
Freedom from folds	44	45	53	47	23	20
Index	40	45	44	22	51	27

Seventeen lines were included in the table. Thirteen of these were included last year and 4 were not. Six lines (21, 32, 34, 40, 44, and 47) have ranked in the high six for one or more traits for each of the last 6 years. Line 45 is the only line included in the first 6 lines for each trait.

SELECTION PRACTICED ON RAMBOUILLET LAMBS

The use of a selection index in the fall of 1946 on weanling lambs resulted in a further increase in the selection differential for ram lambs even though more ram lambs were retained for possible use. Twenty-six percent of the ram lambs were saved in 1946 as compared with 22 percent in 1945. There was a slight decrease in the selection differential for ewe lambs, but 85 percent were saved as compared with 69 percent in 1945. The selection differentials for Rambouillet weanling lambs in 1946 are presented in the following table:

		Face covering score	Staple length (cm.)	Weaning weight (lbs.)	Type score	Condition score	Neck folds score
Rams	Advantage of selected lambs	.40	.21	5.95	.26	.21	.20
	Relative emphasis	.62	.46	.70	.54	.49	.47
	Expected genetic gain	.224	.084	1.785	.034	.008	.101
Ewes	Advantage of selected lambs	.11	.05	1.66	.07	.08	.04
	Relative emphasis	.17	.11	.20	.15	.19	.09
	Expected genetic gain	.062	.020	.498	.009	.003	.016

The relative emphasis placed on each trait was calculated by dividing the selection differential by the standard deviation for that trait. In general, the greatest emphasis was placed on weaning weight, face covering, type and condition with less emphasis on staple length and least on neck folds. The incidence of neck folds has been reduced so rapidly that the opportunity to select has also been reduced.

The expected genetic gain from selecting ram lambs and ewe lambs was obtained by multiplying the selection differential by the heritability for the corresponding trait. These figures are estimates of how much the selected groups are superior in actual breeding value to the unselected groups from which they were chosen. These gains may be changed through later selection. They are particularly apt to be increased for the rams since less than 1/5 of the rams saved at weaning age are usually used in breeding.

If no additional selections were practiced on these lambs the approximate annual rate of improvement would be the sum of the genetic improvement in the ram lambs and the ewe lambs divided by the total age of the parents when the offspring are born. The estimated annual rate of genetic improvement from weanling selections from 1943 to 1946 are presented in the following table:

Year	Face covering score	Staple length (cm.)	Weaning weight (lbs.)	Type Score	Condition Score	Neck folds score
1943	.013	.019	.184	.007	.001	.030
1944	.020	.011	.233	.009	.002	.030
1945	.025	.015	.319	.011	.002	.020
1946	.043	.016	.342	.006	.002	.018

The rate of genetic improvement during the last 4 years has more than tripled for face covering. It has also definitely increased for weaning weight and has remained fairly constant for staple length, type and condition. Genetic progress toward absence of neck folds has decreased but this is due primarily to a decrease in the incidence and variability of neck folds brought about by selection against them. Estimates of the approximate theoretical maximum progress for 1946 are very similar to the rates of progress given in the above table for 1946.

An important factor in increasing the rate of progress from selection has been the reduction in generation length. The average ages of sires and dams when their offspring were born are shown in the following table:

Year lambs were born	Average age of dams (years)	Average age of sires (years)	Average age of sires plus dams (years)
1941	4.41	4.00	8.41
1942	4.37	4.13	8.50
1943	4.23	3.63	7.86
1944	4.05	3.38	7.43
1945	4.01	3.40	7.41
1946	3.97	2.70	6.67

From 1941 to 1946 there has been a reduction in generation length of .44 years for ewes and 1.30 years for rams. The generation length for rams and ewes is about 21 percent less in 1946 as compared with 1941.

INCREASING THE ACCURACY OF SELECTION OF RAMBOUILLET RAMS

Much of the gain from selection comes from the choice of rams to become sires. It is often necessary to discriminate between rams born in different years or raised under different environmental conditions. The differences caused by these environmental effects may be more important than genetic differences. Accuracy of selection for genetic merit or breeding ability may thus be increased by first correcting or adjusting for measurable environmental differences.

Differences between years had the most important environmental effect upon yearling Rambouillet ram traits of any factor studied followed by inbreeding. Type of birth, age of dam and age at shearing did not have important effects on yearling traits. Differences among years were greatest for neck folds, body weight and grease fleece weight. Inbreeding had important effects on body weight, grease fleece weight, clean fleece weight, type score and condition score. Each of these traits became poorer with inbreeding. Accuracy of selecting rams can be increased by adjusting their records for differences in years and inbreeding.

The effect of age on Rambouillet ram records was studied to obtain information for adjusting ram records to a standard age. Grease fleece weights were heaviest in the third year of age, while clean fleece weights were heaviest in the fourth year. Length of staple was also greatest in the fourth year. Body weight was greatest in the fourth year, but was only slightly lower for the fifth year. In general, about 50 percent of the rams were retained each year. For earlier ages the rams retained for another year nearly always excelled the group from which they were selected for each trait. After the 3d and 4th year this was reversed. Evidently factors such as death, unsoundness, infertility and progeny records were more important in determining which older rams remained in the flock than the ram's own records.

Yearly differences and age changes can be adjusted simultaneously by setting up a table giving the average production for each age group for each year involved. Then, for example, the average deviation of a 2-year-old ram born in 1945 from the grand average can be added or subtracted from the record of each ram born in 1945. A correction for increase in accuracy with increasing number of records can also be made in addition to correcting for other important factors such as inbreeding. Ram production records change so with age or years that accurate comparisons between rams of different ages and born in different years are practically impossible before such adjustments are made.

Correlations among lifetime Rambouillet fleece records show greatest repeatability for staple length with about equal repeatability for grease fleece weight and clean weight. Adjustment of yearling fleece records to a standard age on a basis of average daily growth gave slight if any increase in repeatability. Staple length had a higher relationship with clean fleece weight than with grease fleece weight. The highest correlations were found between grease fleece weight and clean fleece weight. These correlations will be useful, when ram records are combined in an index, so that the relationship between traits does not change the relative emphasis desired in selection.

EFFECT OF INBREEDING ON RAMBOUILLET RAMS

Inbreeding had important effects on grease fleece weight, clean fleece weight, body weight, type and condition score of Rambouillet rams. Each of these traits became poorer with inbreeding as shown by the regression coefficients in the following table:

Age of ram	No. of rams	Grease fleece weight (lbs.)	Clean fleece weight (lbs.)	Body weight (lbs.)	Type score	Condition score
1 year	499	-.057	-.020	-.556	.010	.006
2 years	165	-.050	-.020	-.519	.009	.006
3 years	69	-.064	-.023	-.660	.006	.007

It appears that the effect of inbreeding is fairly consistent for each age group. Where differences in inbreeding exist, lifetime averages of the traits affected by inbreeding should be adjusted before comparisons are made. The use of the regression for yearling traits for all ages would appear to be sufficiently accurate for practical purposes.

Inbreeding did not have important effects on face covering, staple length or neck folds of Rambouillet rams.

PROGRESS IN SELECTING FOR SMOOTHNESS WITH RAMBOUILLETS

Continued progress toward the elimination of skin folds was shown by the 1946 weanling lambs. The trend toward elimination of neck folds since the establishment of the Laboratory is shown in the following table:

Year weaned	Average neck fold score	Percent of lambs which have: Practically no folds	Trace of folds	Moderately heavy folds	Fairly heavy folds	Heavy folds
1938	2.35	20	41	27	10	2
1939	1.94	43	32	20	4	1
1940	2.37	21	38	29	9	3
1941	2.07	34	38	22	5	1
1942	1.69	56	28	12	3	1
1943	1.82	48	35	13	3	1
1944	1.57	69	18	9	3	1
1945	1.40	77	18	4	1	0
1946	1.23	82	16	2	0.1	0.1

During this 9-year period the average neck fold score has been reduced from about a 2- to slightly smoother than a 1-. The proportion of practically smooth lambs has increased from 20 to 82 percent while lambs with moderate to heavy folds have decreased from 39 to 2 percent. The standard deviation for weanling neck folds score has been reduced from 0.94 in 1938 to 0.43 in 1946. Further progress toward elimination of skin folds can be expected to be slow, but this is not important as the bulk of the lambs are already free from folds.

SELECTION FOR OPEN FACE IN RAMBOUILLETS

Progress in increasing the incidence of open face in the Rambouillet flock is shown in the following table:

Year weaned	Average face covering score	Percent of lambs with: Open faces	Partially covered faces	Covered faces
1938	4.15	14	58	28
1939	4.28	11	50	39
1940	4.45	11	34	55
1941	4.37	11	40	49
1942	4.26	17	40	43
1943	4.45	8	36	56
1944	4.38	11	44	45
1945	4.54	6	41	54
1946	4.02	25	48	27

Some shifts in scoring standards have apparently occurred. However, the marked increase in proportion of open faced lambs in 1946 is very encouraging. The average face covering score of lambs born in 1946 appears to be very reasonable, as the sires had an average face score of 4.05 and the dams 4.58 at yearling age. In general, faces are more heavily covered at yearling age by from .3 to .6 of a score than at weanling age.

POLLED RAMBOUILLETS

The two polled lines (53 and 54) have now produced a total of 263 offspring. Frequency of the offspring from the different matings are shown in the following table.

Parents	Offspring			
	Horned rams	Rams without true horns	Ewes with knobs	Polled ewes
Horned rams x polled ewes	6	10	11	14
Polled rams x ewes with knobs	10	5	7	11
Polled rams x polled ewes	12	73	19	57
Polled rams x polled ewes (with polled parents)	2	8	4	14
TOTAL	30	96	41	96

There was little change in the frequencies with the addition of the 72 lambs born in 1946. Both sires produced horned offspring. Only 9 of the 96 rams without horns did not have any scur development. One of these w as one of the two sires for 1946.

Polled rams are showing considerable promise as individuals, particularly for body type and open face.

PROGENY TESTING OF RAMBOUILLETS

Six Rambouillet rams were tested in the fall of 1946 on 115 ewes. In addition tests on Rambouillet ewes were made with a ram of Delaine-Merino-Rambouillet breeding obtained from New Mexico and 2 rams resulting from a cross of a New Zealand Merino ram with a Targhee and a Columbia ewe.

MERINO-RAMBOUILLET CROSSES

The New Zealand Merino Ram was mated to 9 select Rambouillet ewes in 1945. The 9 weanling offspring are compared with Rambouillet offspring, after adjustment for environmental effects, of the ewes from which the 9 were selected, in the following table:

Sire	No. of lambs	Face covering score	Staple length (cm.)	Weaning weight (lbs.)	Type score	Condition score	Neck folds score
New Zealand Merino	9	3.30	3.24	66.65	2.40	2.09	2.04
Rambouillet	86	3.73	3.18	75.92	2.02	2.02	1.16

The Merino-Rambouillet offspring had more open faces and slightly longer staple but were smaller and had poorer type and more folds than straight Rambouillets.

IMPROVEMENT OF METHODS FOR PREDICTING FERTILITY OF RAMS

Studies on methods of staining sperm with opal blue showed the optimum stain mixture was 12.5 percent opal blue and 0.5 percent eosin in pH 7.15 phosphate buffer. Under normal conditions motile sperm took no stain and unstained sperm were therefore regarded as the best estimate of live sperm. Prediction of percent live normal sperm on the stained smear from a combination of motility score and percent motile had significant reliability. The opal blue staining method was found to be simpler and more rapid than previous methods, allowing immediate examination for abnormalities of sperm and for proportion of live and dead sperm during routine examination of the semen.

The differential features of tailless sperm in semen, from a pair of rams with good semen qualities and a pair with poor semen qualities, were examined. Smearing created tailless sperm in proportion to the percent already present when poor semen was used, but no more tailless sperm were created than by use of the hemacytometer technique when semen of good quality was used. In opal blue stained smears of good quality semen, all morphologically normal sperm took no stain or both eosin and opal blue, while the tailless were about half of this type, the rest staining with eosin. In smears of poor semen, most of the tailless, and a small percent of the morphologically normal sperm, took only eosin stain. It was concluded that tailless sperm which stained with eosin indicated an inherent weakness of the sperm, and that tailless sperm which took no stain or stained with both opal blue and eosin were artificially formed by the rigors of technique.

Another study was conducted to identify and evaluate the various factors contributing to the accuracy of estimating concentration of sperm in ram's semen and to devise methods which would give most accurate results. The relation between counts of sperm made with a hemacytometer and turbidity readings with a photoelectric colorimeter were analyzed. The technique adopted for use with the colorimeter involved dilution at 1:200 in a 4 percent solution of chlorazene in distilled water. Accuracy of estimating sperm concentration with the colorimeter was increased by scoring for the amount of debris in the semen. The

colorimeter was slightly more accurate and much more rapid than the hemacytometer for estimating concentration of sperm in Ram's semen.

These improvements in methods for estimating semen quality and in predicting fertility of rams from semen quality have practical importance in increasing our ability to select for rams of high feritility. They may also have value in facilitating the use of artificial insemination.

COMMERCIAL GRADES OF RAMBOUILLET FLEECES

Sex	Year	Yearling			Mature		
		Fine French (percent)	Fine staple (percent)	1/2 blood (percent)	Fine French (percent)	Fine staple (percent)	1/2 blood (percent)
Rams	1942-45	6	92	2	6	92	2
	1946	7	93		4	96	
Ewes	1942-45	21	75	4	47	50	3
	1946	3	91	6	19	75	6

There was a marked reduction in the percent of fleeces grading Fine French combing and a corresponding increase in those grading Fine Staple combing with the exception of yearling rams. None of the ram fleeces graded 1/2 Blood in 1946 while there was a slight increase in the percent of ewe fleeces grading 1/2 Blood.

SUMMARY FOR INDIVIDUAL GRADE LOTS 1946 CLIP

Lot No.	Description	No. Fl.	Net Gr. wt.	Clean Yield (%)	Net Adj. clean weight (lbs.)	Percent Sort to net grease weight	Shr.	Ave. grease fleece weight (lbs.)	Ave. clean fleece weight (lbs.)	WFA Appraisal Value per clean pound	WFA Appraisal Total clean value	Ave. clean fleece value	Ave. grease value per lb. Boston	Net grease value per lb. Boston
1	#1 Clear	844	6536	50.6	3310	75.78				$1.00	$4303.00			-.046**
Fine Staple	#1 Burry		957	46.6	446	11.10				1.23	548.58			
Mature Ewes	Stain low-tags		112	32.1	36	1.30				1.06	38.16			
	Paint		392	40.8	160	4.54				1.18	188.80			
	Crutchings		495	40.9	202	5.74				1.06	214.12			
	Tags		133	35.4	47	1.54				1.01	47.47			
Totals and Averages			8625	48.7	4201	100.00	51.3	10.22	4.98	1.27	5340.13	6.32	.6186	.5726
2	#1 Clear	215	1653	48.2	797	74.39				1.27	1012.19			
Fine French	#1 Burry		220	45.0	99	9.90				1.20	118.80			
Mature Ewes	Stain-low tags		43	32.1	14	1.94				1.06	14.84			
	Paint		146	40.8	60	6.57				1.18	70.80			
	Crutchings		126	40.9	52	5.67				1.06	55.12			
	Tags		34	35.4	12	1.53				1.01	12.12			
Totals and Averages			2222	46.5	1034	100.00	53.5	10.33	4.81	1.24	1283.87	5.96	.5770	.5310
3	#1 Clear	323	2441	47.8	1167	81.02				1.28	1493.76			
Fine	#1 Burry		164	45.1	74	5.44				1.20	88.80			
Yearling	Stain-low-tags		216	32.1	69	7.17				1.06	73.14			
Ewes	Paint		116	40.8	47	3.85				1.18	55.46			
	Tags		76	35.4	27	2.52				1.01	27.27			
Totals and Averages			3013	45.9	1384	100.00	54.1	9.33	4.28	1.26	1738.43	5.39	.5787	.5327
4	#1 Clear	178	1354	46.9	870	86.07				1.30	1131.00			
Fine	#1 Burry		104	42.3	44	4.83				1.19	52.36			
Ram	Stain-low-tags		68	32.1	22	3.16				1.06	23.32			
	Paint		72	40.8	29	3.34				1.18	34.22			
	Tags		56	35.4	20	2.60				1.01	20.20			
Totals and Averages			2154	45.7	985	100.00	54.3	12.10	5.33	1.28	1261.10	7.08	.5853	.5393

** Transportation cost per pound grease wool.

RECAPITULATION

Publications:

Because of the relatively small number of workers during the fiscal year it has not been possible to prepare all the papers for publication that may otherwise have been accomplished.

During the fiscal year one publication was revised, namely No. 30. Five manuscripts were published from the Laboratory and seven manuscripts were published from data contributed to by the U. S. Sheep Experiment Station. Seven additional manuscripts were published by the U. S. Sheep Experiment Station.

Progress in Inbred Lines of Rambouillets:

The inbreeding coefficients in percent based on ewes bred increased from 1.1 to 7.1 during the nine years from 1938 to 1946. The increase in rams used was from 4.0 to 5.9, and in progeny from 3.9 to 14.1. The increase of progeny over dams has increased from 2.8 to 7.0 percent.

Selection Practiced on Rambouillet Lambs:

With the use of a selection index the rate of genetic improvement from 1943 to 1946 has more than tripled for face covering. It has also definitely increased for weaning weight but has remained rather constant for staple length, type and condition. Estimated genetic improvement for absence of neck folds has decreased because progress has been made through selection against them.

Change in Generation Length:

Rate of progress in sheep improvement is relatively slow because they reproduce slowly. In an effort to speed up improvement the generation length has been reduced from 4.41 in the average age of dams in 1941 to 3.97 in 1946, and in rams from 4.00 to 2.70 years. Thus in ewes the reduction has been .44 and in rams 1.30 years, or approximately a 21 percent reduction. This reduction for rams has come about by increased statistical facilities developed at this Laboratory for more efficiently evaluating young rams, thus reducing the emphasis on progeny testing rams, which in many cases reduces the generation length by one year.

Increasing the Accuracy of Selecting Rambouillet Rams:

This is accomplished by adjusting for measurable environmental differences. Environmental advantages often confuse the selection for genetic differences.

Effect of Inbreeding on Rambouillet Rams:

The effect of inbreeding is fairly consistent in rams from one to three years of age. Grease and clean fleece weights, body weight, type and condition score became poorer with inbreeding.

Progress in Selecting for Smoothness in Rambouillets:

The proportion of practically smooth lambs increased from 20 to 82 percent from 1938 to 1946 and the lambs with moderate to heavy folds increased from 39 to 2 percent of the lambs at weaning time.

Selection for Open Face in Rambouillets:

Lambs with open face increased from 14 to 25 percent from 1938 to 1946. Examination of mature sheep in the flock indicates that somewhat greater progress toward more open faces may have been made. These sheep are highly selected and the greatly increased selection differential for open face, mentioned previously, may account for part of this difference. Also slight fluctuation in scoring standards sometimes mask progress for traits such as face covering.

Polled Rambouillets:

Encouraging progress is being made with the polled character and the quality of the sheep in the lines is high.

Merino-Rambouillet Crosses:

There is not too much encouragement noted in the F1 Merino-Rambouillet crosses. However, it is expected that some advantages from the cross may be more fully realized in future combinations.

Commercial Grades of Rambouillet Wool:

Seventy-five percent of the mature ewe fleeces graded Fine Staple in 1946, compared with 50 percent in 1942-45 or a 50 percent increase. A substantial increase is also noted in the yearling ewes.

It will be noted in the table on page 14 that the additional weight of clean wool and the higher price of the Fine Staple fleece is enough to pay the freight to Boston. It is also noted that the Fine French is almost equal in yield of clean wool per fleece to the Fine Staple. This denotes the high quality of the fleeces included in the Fine French grade.